IMPROVEMENT OF HUNGARIAN JOINT TERMINAL ATTACK PROGRAM

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In 2006, Hungarian Defense Force started a Joint Terminal Attack Controller Program in order to provide access to joint fire support for Hungarian ground forces participating in NATO missions. The program made progress, and was accredited initially in 2012. However, there are shortfalls in the program, hence it still relies on assistance of the US. This thesis examined the possible improvement of the Hungarian JTAC Program in order to make it more effective and independent. The study focused on four fields: material, facilities, training, and organization. The method of the research was comparing the existing Hungarian conditions with an ideal program based on US standards and experiences in order to highlight the gaps require feasible solutions for improvement. The result of this study is that conditions and resources of Hungarian Defense Force meet the requirement of sustaining the existing JTAC program. However, the shortfalls in material and facilities preclude an effective Hungarian certification training. Therefore, international cooperation with NATO partners is essential not just in case of sharing experience, but in case of initial training of Hungarian JTACs as well.

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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

IMPROVEMENT OF HUNGARIAN JOINT TERMINAL ATTACK PROGRAM, by CPT Imre Marton, 65 pages.

In 2006, Hungarian Defense Force started a Joint Terminal Attack Controller Program in order to provide access to joint fire support for Hungarian ground forces participating in NATO missions. The program made progress, and was accredited initially in 2012. However, there are shortfalls in the program; hence it still relies on assistance of the US. This thesis examined the possible improvement of the Hungarian JTAC Program in order to make it more effective and independent. The study focused on four fields: material, facilities, training, and organization. The method of the research was comparing the existing Hungarian conditions with an ideal program based on US standards and experiences in order to highlight the gaps require feasible solutions for improvement. The result of this study is that conditions and resources of Hungarian Defense Force meet the requirement of sustaining the existing JTAC program. However, the shortfalls in material and facilities preclude effective Hungarian certification training. Therefore, international cooperation with NATO partners is essential not just in case of sharing experience, but in case of initial training of Hungarian JTACs as well.

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Moreover, I want to highlight those members of Hungarian Defense Force, whose enthusiastic work created the Hungarian JTAC program from scratch and supported the progress we made.

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ACRONYMS

ALO	Air Liaison Officer
CAS	Close Air Support
DOTMLPF	Doctrine Organization Training Material Leadership Personnel Facility
FAC	Forward Air Controller
FLIR	Forward Looking Infrared
GLTD	Ground Laser Target Designator
HDF	Hungarian Defense Force
JFO	Joint Fires Observer
JTAC	Joint Terminal Attack Controller
LST	Laser Spot Tracker
NVG	Night Vision Goggle
ROMAD	Radio Operator Maintainer and Driver
ROVER	Remotely Operated Video Enhanced Receiver
TACP	Tactical Air Control Party

CHAPTER 1

INTRODUCTION

After spending five years in the joint terminal attack controller (JTAC) community, I want to challenge myself to research my field and find solutions to make our system more effective. The first chapter of my thesis is a short explanation of the problem and its relevance to the Hungarian Defense Force (HDF).

The Research Question

The purpose of this thesis is to answer the question: How should the Hungarian Defense Force create an independent and more effective JTAC/FAC program? To find the proper answer, three areas must be investigated.

First, what are the necessary resources to run a JTAC program? Resources are aircraft able to fulfill close air support missions, up-to-date personal equipment, and proper training environment (ranges, simulators, etc.). Also, if Hungary already has all of the resources required, what kind of improvement is needed?

Second, what are requirements to create a JTAC training program that meets current NATO standards?

Third, what is the proper allocation of JTACs to provide the necessary number of controllers for missions, while maintaining a current training program?

Background of the Problem

Coordination between the ground force commander and aircraft attacking ground targets in close proximity to friendly forces is crucial for every military force in order to eliminate the chance of fratricide and to mitigate collateral damage. This task was

determined in former doctrines of Warsaw Pact forces as well. So, the requirement of coordination between air and ground in case of air strikes was not a brand new idea for HDF, when Hungary became part of the NATO in 1999. Originally, helicopter pilots were assigned the occasional task of coordination, but they did not serve as full-time controllers in Hungarian Defense Force. Although they received initial training on forward air controller (FAC) procedures in NATO schools and adopted those procedures in Hungarian publications, they did not meet NATO requirements. Consequently, Hungarian controllers were constrained to Hungarian assets and territory.

After Hungary joined NATO, the number of tasks related to multinational missions increased significantly. For instance, Hungary offered different types and sizes of units to NATO Response Forces, where the evaluation of units is based on common NATO regulations. During these tasks the need for a joint capability for air-to-ground integration in infantry units became apparent. Based on the NATO obligations and experiences in Afghanistan, HDF established a small unit to provide full-time forward air controllers, who have NATO qualifications, and can participate in multinational missions as well. The unit was comprised of young infantry officers assigned to controller duties. Unit training started with English language courses, but access to accredited NATO schools was very limited. Thus, the first professional training of controllers was based on NATO standards, but conducted by experienced helicopter pilots in Hungary.

In 2009, the United States (US) offered to help Hungarian controllers attend the Joint Terminal Attack Controller Qualification Course of United States Air Force Europe (JTACQC USAFE) at Ramstein Air Base, Germany, and the Tactical Air Control Party Course of United States Marine Corps Expeditionary Warfare Training Group Atlantic

(TACP USMC EWTGLANT) in Norfolk. These courses provided classroom instruction and some limited practical training. To finish the training and certify controllers, Hungary gained access to Grayling Air Gunnery Range in Michigan. Thirteen Hungarian candidates completed the course and became certified and qualified controllers until November 2012.

Initial NATO accreditation of the Hungarian JTAC Program occurred in September 2012, when a Combined Standardization Team with members of US Joint Fire Support Executive Steering Committee and NATO Forward Air Controller Standardization Team visited Hungary to review Hungarian documentation and capabilities related to the JTAC program. While, the team recommended the initial accreditation of the Hungarian JTAC program, many recommendations to deal with existing issues contained in the report written by the Combined Standardization Team. Most of the issues emerged from shortfalls in training systems and technical assets, and reflected that Hungary still relies on foreign assistance such as providing JTAC Evaluators for continuation training, procuring or receiving assets through Foreign Military Finance (FMF) or the Foreign Military Sales (FMS) program of US Department of Defense. The Combined Standardization Team will return between twelve and eighteen months from the initial accreditation in order to conduct a follow-up review. During this period, HDF is working to correct identified deficiencies.

Hungary appreciates the assistance of the United States, but it is apparent that the Hungarian JTAC program cannot rely on the resources of an allied country in the long term in order to have a fully accredited and sovereign program. Furthermore, the entire NATO community faces a similar problem with the low number of JTACs available in

operational areas. The major reason for shortfalls is limited resources such as limited capacity of JTAC schools, and lack of sorties and training events for JTAC continuation training. In this case, HDF has to increase JTAC capabilities rather than just exploit the opportunities offered by NATO partners. Therefore, Hungary must investigate how to improve its program based on HDF resources, and develop training that provides NATO qualified controllers.

Assumptions

The researcher assumes that Hungarian Defense Forces will need more JTAC in the future and have the basic resources for conducting an effective JTAC program. Research of the US JTAC program will provide significant help to improve the Hungarian JTAC program.

Definitions

Close Air Support (CAS). Air action by fixed- or rotary-wing aircraft against hostile targets that are in close proximity to friendly forces and that require detailed integration of each air mission with the fire and movement of those forces.[1]

Forward Air Controller (FAC). An officer (aviator/pilot) member of the tactical air control party who, from a forward ground or airborne position, who directs aircraft in close air support of ground troops.[2]

Forward Air Controller (FAC). A qualified individual who, from a forward position on the ground or in the air, directs the action of combat aircraft engaged in close air support of land forces.[3]

Forward Air Controller Instructor (FAC-INS). A qualified FAC who is assigned to an instructor position within an authorized FAC training programme. The FAC-INS must have successfully completed an authorized instructor training programme.[4]

Joint Terminal Attack Controller (JTAC). A qualified (certified) service member who, from a forward position, directs the action of combat aircraft engaged in close air support and other offensive air operations. A qualified and current joint terminal attack controller will be recognized across the Department of Defense as capable and authorized to perform terminal attack control.[5]

JTAC Instructor (JTAC-I). A highly qualified JTAC who is designated as a course instructor. A JTAC-I is authorized to instruct JTAC trainees.[6]

JTAC Evaluator (JTAC-E). A qualified JTAC Evaluator is a JTAC that has been designated to conduct comprehensive and 18-month JTAC evaluations. JTAC-E requires a minimum of one year of operational experience as a qualified JTAC and will be designated by his unit commander.[7]

Joint Fires Observer (JFO). A trained Service member who can request, adjust, and control surface-to-surface fires, provide targeting information in support of Type 2 and 3 close air support terminal attack control, and perform autonomous terminal guidance operations.[8]

Laser Operator (LO). An individual who is qualified to conduct laser marking and designation missions in support of FACs.[9]

Supervisory Forward Air Controller (SUP-FAC). A qualified FAC who has at least one year of continuous experience in the category he is supervising. He is authorized to supervise the currency training of the FACs under his responsibility. The

SUP-FAC must have accomplished additional academic training in air operations, airspace control and teaching/training techniques.[10]

Tactical Air Control Party (TACP). A subordinate operation component of a tactical air control system designed to provide air liaison to land forces and for the control of aircraft.[11]

Scope

This thesis will focus on what Hungary should do to improve its JTAC program. Determining a solution involving other countries as contributors is not a goal of this work.

Limitations

The research and conclusions will be kept at the unclassified level. Most of the statements, especially those related to improvement of resources, have a financial consequence. This work will be limited in the meaning of calculating expenses, and budget planning.

Delimitations

The study on allocation of JTACs and structure of TACPs will be limited to battalion and brigade level because of the size of Hungarian Defense Forces.

Significance of the Study

The intent of this study is to improve the Hungarian JTAC program, and demonstrate that an improved program is an obtainable goal for Hungary. The importance of this goal is to develop a solid background in providing JTACs for land forces in different missions such as ISAF or NATO Response Forces. Furthermore, this

capability would significantly affect the cooperation between neighboring countries and Hungary.

Conclusion

This chapter introduced the main research question of the thesis dedicated to answer, provided a short introduction about the background of Hungarian JTAC program, and about the necessity of improving this program. Furthermore, relevant definitions used in other chapters were listed. The sources available and needed for this thesis will be discussed in the form of a literature review in chapter 2.

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[1]Chairman, Joint Chiefs of Staff, Joint Publication 3-09.3, *Close Air Support* (Washington, DC: Government Printing Office, 8 July 2009), GL-9.

[2]Ibid., GL-12.

[3]NATO Standardization Agency, ATP 3.3.2.1(C), *Tactics Techniques and Procedures for Close Air Support and Air Interdiction* (Brussels, Belgium, 11 February 2011), Lexicon-8.

[4]NATO Standardization Agency, STANAG 3797 AO (Edition 4)–*Minimum Qualification for Forward Air Controllers and Laser Operators in Support of Forward Air Controllers* (Brussels, Belgium, 27 April 2009), 4.

[5]Chairman, Joint Chiefs of Staff, GL-15.

[6]Joint Staff, JCAS AP MOA 2004-01, *Joint Terminal Attack Controller (JTAC)(Ground)* (Washington, DC: Government Printing Office, 1 September 2010), 89.

[7]Ibid.

[8]Chairman, Joint Chiefs of Staff, GL-15.

[9]NATO Standardization Agency, STANAG 3797, 4.

[10]Ibid.

[11]Chairman, Joint Chiefs of Staff, Joint Publication 3-09.3, GL-18.

CHAPTER 2

LITERATURE REVIEW

Chapter 1 introduced the purpose, background, and boundaries of this thesis, which is about confirming the capability of Hungarian Defense Forces to improve the Hungarian JTAC program. Chapter 2 presents the existing literature necessary to conduct this work. The nature of CAS requires clear and detailed written regulations and doctrine. Furthermore, the importance of CAS for land forces and the limited access to CAS motivated the services to present a wide range of studies and articles related to this topic. The primary sources for this work are official military publications setting the requirements of JTAC training and procedures. Secondary sources were studies related to lessons learnt in theater, training methods, and the structure of air command and control systems.

Publications

There are three different sets of publications about the JTAC topic: NATO documents, US military publications, and HDF publications. Normally, the national level doctrines of US and Hungary are subordinate to NATO doctrines, and Hungarian doctrines may not differ significantly from NATO and US publications. However, the situation is not so apparent especially in NATO and US publications, where many minor differences exist. For instance, there are differences even in basic tactics, techniques and procedures such as the method of giving a CAS 9-line brief to the crew of the engaging aircraft, when the JTAC should read the title of every line according to the NATO regulation, but US regulation prohibits any additional information other than the

necessary data. Similar phenomenon is using the expression “In Hot” by NATO instead of using “In” with heading in order to avoid the confusion with the expression of “Cleared Hot”. Although these types of differences are important, they are manageable through proper standard operating procedures (SOP) in theater. The more relevant ambiguity is found in documents regulating JTAC training in which entire definitions are different. For example, the determination of JTAC training levels and responsibilities differs in the US system from the system of NATO. US publications define the sequential levels based on experience and authority as JTAC Trainee, JTAC, JTAC Instructor, and JTAC Evaluator. In contrast, NATO documents mention FAC Candidate, FAC, Supervisory FAC, and FAC Instructor. At first glance, using JTAC and FAC is the main dissimilarity. Even if the NATO publication states these expressions are synonymous, the meaning is not fully the same, because NATO uses FAC as a general expression, but the US version of FAC refers for aviator officers with proper training and authority for CAS only, and JTACs have ground background. In fact, the main difference is in the content of definitions. A JTAC Instructor is not equal with a Supervisory FAC. To add to the confusion, both systems use the word instructor, but a JTAC instructor has less authority than a FAC instructor. Additionally, NATO has training categories like Day Low Level, or Night Low Level specialization, which in the US system does not exist. Although these differences are handled with flexibility in practice, the doctrinal background still shows ambiguity, which means HDF has to take into consideration and implement both systems.

As a result, both NATO and US regulations were researched and compared simultaneously. In the case of US publications, joint documents were significant.

With regards to CAS definitions, procedures, air command and control structures, and requirements generally, the fundamental NATO document is the ATP-3.3.2.1 (C), *Tactics Techniques and Procedures for Close Air Support and Air Interdiction* published by NATO Standardization Agency in 2011. The equivalent US version of the previously-mentioned NATO document is the Joint Publication 3-09.3, *Close Air Support*, published by US Joint Staff in 2009.

The other large field is the requirements and process of JTAC training. Significant regulations are: STANAG 3797 (ed4), *Minimum Qualification for Forward Air Controllers and Laser Operators in Support of Forward Air Controllers* published by NATO Standardization Agency in 2009, JCAS AP MOA 2004-01, *Memorandum of Agreement* published by Joint Staff in 2010, and *Hungarian JTAC Program* published by Hungarian MoD General Staff in 2012.

Studies and Articles

Doctrine providing fundamental principles to employ forces is relevant when determining basics. However doctrine does not give a detailed solution how to conduct training, and how to organize forces. Doctrine provides a starting point and defines basic requirements, but real effectiveness comes from the use of practical experience. In order to gather more information about practical experiences, the best way is to find studies and research papers written by subject-matter experts, and use these sources to supplement official materials. A significant criterion in selecting proper sources is actual experience. The last relevant changes in doctrinal background related to JTAC procedures and training occurred in 2009. Therefore, careful use of articles and studies written before

2009 is necessary. Considering these criteria the author found the following secondary sources during the research.

The Combined Standardization Team, which composed the representatives from the JTAC Standardization Team of US Joint Fire Support Executive Steering Committee and from the NATO Forward Air Controller Standardization Team, conducted the initial accreditation of Hungarian JTAC program, and produced an important report. The report is the result of the Team`s visit in 2012, where the reviewed Hungarian capabilities and revealed shortfalls and issues important for improvement. Furthermore, this report founded and proved the significance of the research related to the improvement of Hungarian JTAC program.

Researching the requirements and capabilities of CAS aircraft and JTAC inventory, the database of *Military Periscope,* which presented full collections of information related to technical data, and *IHS Jane`s Defense Industry Solutions*, which provided wide array of articles according to military procurements, were relevant and helpful. In case of training facilities like air-ground ranges and JTAC simulators, the majority of findings come from studies published by the RAND Corporation and by the Air Force Research Laboratory.

In contrast to the mentioned fields of research, materials detailing training methods, for instance studies published by JTAC schools, were not available. To compensate this shortfall, articles describing contemporary situation and requirements in theater were the foundation of the training field discussed in this thesis. Articles in *Air Sea Land Bulletin* published by Air Land Sea Application Center (ALSA), and in the

Marine Corps Gazette provided apparent perception on which the JTAC training has to focus.

Also, the Rand Corporation published a study pertaining to the feasibility of career field of air liaison officers which provided an answer to significant issue of HDF. Furthermore, many articles in *Marine Corps Gazette* discussed the capabilities of TACPs.

Proving the importance of CAS and connecting terminal attack controlling, many theses were available from different education institutes of the US military services such as the Air University Air Command and Staff College, US Army Command and General Staff College, and the Marine Corps University Command and Staff College. These sources contribute to understanding practical consequences better.

Conclusion

The purpose of this chapter was to introduce the available literature useful for researching the topic related to the improvement of Hungarian JTAC program. The sources found demonstrate that the domain of CAS and JTAC has a detailed regulation in form of doctrine. In addition, a wide range of studies and research materials are available. However, there are some limited fields where studies are not published, or are not open source. One of these fields revealed during research was the method of JTAC training. The research methods on how to find the answer for the research question of thesis using the listed literature above will be presented in chapter 3.

CHAPTER 3

RESEARCH METHODOLOGY

The primary research question of this thesis, how to improve the Hungarian JTAC program, demonstrates that the solution is based on identifying the difference between the existing program and future HDF JTAC program requirements. After chapter 2 introduced the available sources, chapter 3 will discuss the method of the research, how the data needed for this research was collected and analyzed. Moreover, this chapter provides the apportionment of the thesis into fields of study.

Method

This paper is the result of a qualitative research approach and provides explanations and narrative descriptions about the domains within a JTAC program with lesser emphasis given to numerical quantification.[1] The main method was analysis of current doctrines, studies and articles available in order to collect and categorize information for chapter 4.

The first step was to identify the requirements of a JTAC program based on the criteria such as obligation defined by a doctrine, and role of improving effectiveness. NATO and US publications, which were primary sources, provide the doctrinal requirements. Articles and studies provided further requirements coming from practical experiences. In addition, US Air Force officers, who served in this field as CAS pilots or JTACs, were available, in CGSC Class 13-01 to test information about practical solutions of increasing effectiveness. All in all, reviewing these publications provided information

needed to reach the goal of this step which was determining a kind of ideal JTAC program.

Step two was surveying of the conditions and capabilities of HDF through using the type requirements revealed in step one. Hungarian subject-matter experts and domestic regulations were available to gather enough information about the resources of HDF.

Step three used comparison method in order to match the rules, facts, and data resulted from step one and step two in each specified field of research. The aim of this step was to reveal differences and shortfalls between an ideal JTAC program and the existing conditions and capabilities of HDF JTAC program.

The last step determined ways to mitigate or eliminate the differences, and to analyze the identified methods and their feasibility in the Hungarian environment. The final step concluded by asking if Hungary has sufficient resources to meet the identified requirements, or what type of realistic solutions are available to do so.

Fields of Research

The purpose of this thesis is to answer the question: How does the Hungarian Defense Force create an independent and more effective JTAC/FAC program? The US Army Force Management model defines capability gaps, capability needs, and approaches through the domains of Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel and Facilities (DOTMLPF).[2] These domains provide a proper framework to identify solutions to the issue at hand. However, dealing with all domains in detail is not necessary for answering the research question. Therefore, only the material domain, facilities domain, training domain, and organization domain is

used for analysis. However, other domains are discussed but are not necessary to answer the primary research question.

The first domain, material solutions, identifies equipment required for the Hungarian Defense Force's JTAC program. By determining the requirements for CAS capable aircraft, and the minimum requirements for JTAC equipment, the material domain will compare existing requirements with existing resources. The analysis identifies shortfalls in the JTAC program and suggests that either the current resources are enough for an independent program, or further investments are necessary.

The second domain, facilities, identifies training facilities required for the HDF JTAC program. This domain looks for the answer to what the features of an optimal air-to-ground shooting range are. Furthermore, it discusses the significance and types of simulators used in JTAC training. The intent is to evaluate the central shooting range of HDF from JTAC training perspective, and to introduce JTAC simulators necessary to HDF to improve its JTAC program.

The third domain, training, identifies training requirements for a successful JTAC program. This domain identifies the requirements for basic level academic and practical training, and a way for sustaining training.

The fourth domain, organization, describes the recommended structure for Hungarian TACPs attached to land forces at battalion and brigade level.

Conclusion

Chapter 3 presented the basic method of research process and introduced the four domains of DOTMLPF which will be described in detail in chapter 4.

[1]Education.com, “Qualitative Research,” http://www.education.com/definition/qualitative-research/ (accessed 9 April 2013).

[2]US Army CGSC, F100: *Managing Army Change* (Fort Leavenworth, KS: CGSC, 2012), F102RD-1.

CHAPTER 4

ANALYSIS

The purpose of this chapter is to answer the research questions in order to identify requirements for a sustainable and improved Hungarian Defense Force JTAC Program. Using the DOTMLPF model, which is designed to identify capability gaps and solutions, facilitates logical organization of chapter 4, and permits a full spectrum overview of the problem. The first section investigates materials needed for a JTAC program. The second section identifies requirements of facilities. The third section discusses the domain of JTAC training. Finally, the fourth section introduces the problems with TACP organizational structure.

Material Domain

The main task of the section is to compare Hungarian material resources, and requirements, thus revealing material shortages. These shortfalls form part of the determination if the Hungarian Defense Force is able to create an independent JTAC program. This section uses the material domain of DOTMLPF model. The material domain is the most important because the requirements for CAS capable aircraft are extensive and complex. First, proper aircraft with minimum requirement of features, instruments, and armaments are the foundation of CAS. Moreover, the required material inventory for JTACs grew significantly in last two decades. Terminal air control became dependent on technology, and this situation resulted in further requirements and minimum equipment lists. As mentioned already, the main task of the section is to

compare Hungarian resources and requirements, and reveal shortfalls, but then recommend possible solutions for material gaps in the Hungarian JTAC program.

CAS Aircraft

The perception within the Hungarian Defense Forces and especially in the special forces community was that joint terminal attack controlling is an individual requirement vice a program requirement, and it is an independent capability necessary for air support rather than a capability for the HDF. However, in the bigger picture, the focus should be on the support provided by aircraft capable of attacking ground targets effectively. The JTAC`s role is to identify targets accurately in order to minimize fratricide and collateral damage, which are possible negative outcomes of close air support. Consequently, all of the JTAC`s activities are based on the capabilities of CAS capable aircraft. JTACs are not independent, but they are part of a complex system. Furthermore, the training of JTACs is feasible only if CAS capable aircraft are available. Therefore, the capabilities of available aircraft play a relevant role in the procedures and training of JTACs.

Capabilities of a CAS Aircraft

What are the minimum capabilities for an aircraft are in order to meet the requirements for JTAC training? United States military regulations and the JTAC Memorandum of Agreement, identifies the difference between rotary-wing and fixed-wing aircraft only. Regarding certification and continuation training, both types are proper, but the priority is on fixed wing aircraft because of fixed-wing capabilities. This means that training must use fixed-wing aircraft, but may however include training with rotary-wing aircraft. In contrast, NATO regulation, STANAG 3797, requires the use of

fixed-wing only for close air support training. The difference between the requirements centers on aircraft speed. STANAG 3797 requires that CAS aircraft must exceed 300 knot indicated air speed (KIAS), and training aircraft must exceed 200 KIAS. The third category involves every aircraft with speed less than 200 KIAS, so rotary-wing aircraft are included in this category.

According to STANAG 3797, using air assets other than close air support or training aircraft for certification training is not allowed, which means the NATO regulation does not allow the use of rotary-wing aircraft. Distinguishing between fixed- and rotary-wing aircraft is understandable from a JTAC perspective, because controlling a rotary-wing asset requires different techniques than controlling fixed-wing aircraft. Nevertheless, helicopters are extremely capable against ground targets in close proximity of friendly forces, and helicopter crews are receiving training on CAS procedures as well. Based on the experiences in Iraq and Afghanistan, rotary-wing aircraft crews began to use CAS procedures to increase the level of integration. Therefore, while fixed-wing CAS aircraft are preferred, using helicopters as secondary assets in CAS is not an untested idea.

NATO also emphasizes speed of the aircraft as an important factor for aircraft requirements. The reason for this emphasis is the higher the speed of the aircraft the harder to identify the aircraft on final approach for the controller. Another important factor is the speed for CAS and tactical air control. For instance, the speed of A-10, which is the most formidable CAS platform in the world, barely exceeds the limit of 300 KIAS. Furthermore, turboprop-driven fighters as CAS platforms became widely used for missions as well for this reason.[1] Air operations in Iraq and Afghanistan convinced CAS

experts that low speed aircraft can provide CAS in a low-level threat environment. Light attack aircraft such as the Hawker Beechcraft AT-6B Texan II provide CAS or armed over watch with longer operating time on station. So, the dominance of jet fixed-wing aircraft in CAS may decrease in the future. However, a JTAC program still requires a fixed-wing aircraft with speed that exceed 300 KIAS.

During CAS operations the impact of the armament delivered by the supporting aircraft is important for effectiveness. When conducting operations in the offense or the defense, the main targets in regular warfare are armor formations in close proximity of friendly units. Consequently, the armor penetration effect of the ordnance, and the capability of hitting moving targets is relevant. On the other hand, accuracy is a key factor in irregular warfare, where urban areas are congested. Collateral damage is an inevitable issue. CAS aircraft must be able to deliver multiple types of ordnance to be effective.

A basic JTAC training requirement involves the live terminal attack control using live and training ammunition. Training ordnance is the priority because the expense of live ammunition used for training would be unaffordable for many defense forces. Therefore, training ordnance such as BDU-33, which is the training version of MK 82/84 general purpose bomb family, or the laser guided training round (LGTR), which is the training version of Paveway II laser guided bomb family, are essential in a JTAC program.

The increasing use of stand-off weapons; ordnance released out of the range of enemy air defense, requires the improvement of target acquisition systems because of the longer distance between the attacking aircraft and the target. The targeting capability of

CAS aircraft is a key factor, in addition to the type of ordnance used. From a JTAC training perspective nighttime training and use of laser is also important.

Terminal air control at night is mandatory for certification and continuation training. However, the procedure of night controls is not very detailed in training documents. From the air crew view point, two types of night missions are distinguishable based on altitude. Night mission with low altitude procedures requires night vision goggles (NVG) because pilots must orient on terrain features. In contrast, missions at high altitude require a forward looking infrared (FLIR) system. In some cases, in which the pilot does not need to see the target on the ground, such as using ground laser target designator (GLTD) in a laser targeting procedure, or using GPS guided munitions based on highly accurate coordinates provided by a JTAC, even FLIR is not needed, because these bomb-on-coordinate missions are exactly the same like they would be in the day time. So, a proper CAS aircraft for effective JTAC training must be NVG capable, or must have FLIR at least.

Laser capability is another important material requirement for CAS aircraft. Laser systems contain two important components. A low energy range finding system in order to create target coordinates, a high energy designator system for laser guided bombs, and an infrared pointer for visual target designation. The other component consists of a laser spot tracker (LST), which identifies targets by tracking laser energy reflecting from the target designated by a GLTD or by another aircraft. Use of GLTD is a requirement for a JTAC to become and to remain qualified. However, the procedures for use of GLTD are not detailed in doctrine. Even so, the use of GLTD to designate the target for the air crew

using LST in order to determine the position of the target is a standard procedure. As a result, the LST must be considered as a material requirement for a CAS aircraft.

The last group of requirements centers on digital communications. Although data communication in the CAS world is common, it is not reliable because of the interoperability problems between different systems. A great example of interoperability is the remotely operated video enhanced receiver (ROVER). This asset is able to receive real time video from the attacking aircraft. As a result, the JTAC sees the same picture of the target the pilot sees. The ROVER made CAS safer; hence it became an essential for JTACs. Although the use of ROVER is not mandatory in practical training yet, the debates in forums dedicated to improve JTAC training predict that the ROVER will be inevitable in the close future.[2] Therefore, digital capabilities, especially the ROVER system, are essential for a modern CAS aircraft.

In summary, the following capabilities of CAS aircraft are necessary for developing and maintaining an effective JTAC program according to the NATO FAC and US JTAC training regulations: a fixed-wing aircraft with speed exceeding 300 KIAS, training or live ordnance for live terminal attack controls, forward looking infrared sensor, night vision goggles, infrared pointer capability for every type of night time missions, laser spot tracker for laser spot search missions, remotely operated video enhanced receiver emitter for full motion video transmitting, and digital communication system for digital.

Hungarian CAS Capabilities

After identifying minimal capability requirements for a CAS aircraft, the next step is identifying available HDF air assets for JTACs. Hungary, as a former Warsaw Pact

country inherited and operated Soviet aircraft after the fall of the Iron Curtain. The decreasing military budget, the age of the aircraft, and maintenance problems led to the removal of the SU-22 M3 fighter bomber in 1997. The Mi-24 Hind attack helicopter remained the only aircraft with air-to-ground capability. The Mi-24 is an extremely capable aircraft for firepower, but uses technology of the 1980s. Therefore, the instruments and target acquisition systems on board require modernization especially for night capability. Nevertheless, the Mi-24 provides an excellent opportunity for JTAC training in daytime with its wide range of armament. Furthermore, the air crews are experienced in CAS procedures and can support JTACs in academic training as well. Unfortunately, the lack of spare parts decreased operational time, which endangers keeping this aircraft in service. By the end of 2012, all Mi-24s depleted available operational time and need factory maintenance for further service. Although the future of Mi-24 is uncertain, the Hungarian Defense Forces started to investigate the possible solutions of lengthening the time of service and modernization which would make possible to keep this aircraft in service and to implement as a CAS platform in the Hungarian JTAC program.

The maintenance problem also affected the air-to-air aircraft fleet as well. After removing the MiG-23 and MiG-21 from the service in 1997 and in 2000, Hungarian military leaders started to study the replacement of the remaining MiG-29 type. Instead of choosing to continue use of the MiG-29, Hungary selected Sweden's JAS-39 Gripen, and signed a lease-purchase agreement in 2001.[3]

In parallel with the procurement process, the training of pilots was started as well. After selection, Hungarian pilots received basic training trough the NATO Flying

Training in Canada (NFTC), and following the Canadian training, they received advanced training in Sweden starting in 2005.

The Gripen is a fourth generation, lightweight, single-engine, multi-role fighter. JAS stands for Jakt-Attack-Spaning, which means Interceptor-Strike-Reconnaissance in English. The original purchase of the JAS-39 A/B version provided an adequate air-to-air capability after the MiG-29 finishes its service. Later on, the contract was modified in order to procure NATO interoperable assets which have NATO compatible avionics in the cockpit and a retractable air to air refueling system. The modified aircraft became the JAS-39 C/D which is considered the latest model of the type. The C version has a single seat, while the D version is a two-seat aircraft. The first five aircraft arrived in Hungary in 2006, and the remaining nine aircraft arrived in 2007. All aircraft were in operation by the end of 2008.[4]

Although the Gripen was procured for an air-to-air role, it is a multifunctional aircraft, and the Hungarian pilots received basic level air-to-ground training as well. Consequently, the HDF rethought the role of aircraft, and as a result, the Gripen became the backbone of Hungarian JTAC program as a modern fixed wing CAS platform. The Load Diffuser 2010 multinational exercise held in Hungary was the first event where the Gripen, cooperating with F-16s from Ohio Air National Guard, was introduced in a CAS role.

Because of the uncertain future of Mi-24, and the fact that the original JAS-39 Gripen contract was extended until 2026,[5] the capabilities of JAS-39 will influence the feasibility and effectiveness of the Hungarian JTAC program. The Gripen is a fixed wing aircraft with speed exceeding 300 KIAS. Therefore, it meets the requirement of CAS

aircraft category described by NATO regulation. As previously mentioned, the HDF procured the Gripen for air-to-air missions; hence the air-to-ground armament has significant shortfalls. The current weapons are the Mauser BK-27 cannon, and the infrared and TV guided version of AGM-65 Maverick missile. As a result, the only weapon system available for JTAC training is the 27mm cannon.[6] The range and price of Maverick missile prevents its usage. Purchasing of general purpose bombs, and precision guided munitions, such as laser guided or GPS guided bombs which the Gripen can employ is under study. The real short term problem is the lack of training armament such as the BDU-33 or LGTR.

The Gripen has advanced target acquisition capabilities. The Ericson Saab PS-05A type radar provides an all-weather air-to-ground attack capability. Furthermore, the HDF signed a contract with the German Carl Zeiss Optronik Gmbh company, and purchased the Litening GIII surveillance and designation pod. This pod provides FLIR capability and assets such as LTD, LST, LRF and infrared pointer, which are essential for target designation and for determination of target location. The FLIR allows the Gripen to conduct high altitude night CAS missions. However, the low level night CAS missions are not feasible, because the pilots are not qualified to use NVG even if the cockpit is NVG capable. The Gripen`s digital CAS capabilities include the link 16 datalink and Have Quick secure communication, but it does not have ROVER emitter, so the full motion video downlink is not available.[7]

All in all, the Hungarian Gripens have the basic features required for CAS platforms, and support the Hungarian JTAC program, but with serious limitations in term of effectiveness. The Gripen is limited in air-to-ground armament, although the Mauser

BK-27 cannon is available for live missions. This issue could be mitigated by procuring training munitions in short term, and by procuring more types of live ammunition in long term. The NVG training of pilots is required for low level night missions, although the FLIR capability provides the option of high level night missions. Finally, the missing ROVER capability is a significant shortfall, even if this capability is not required by regulations. The existing solution for this shortfall is procuring ROVER emitter module to upgrade the Litening GIII pod. Another solution is the Block 20 upgrade program to support ROVER imagery data link.[8]

JTAC Inventory

The improvement of CAS systems and digital communications changed the perspective for terminal attack control. The available new assets show a new direction based on technology enhancing the conventional procedures, in which JTACs used a single radio and a map. Therefore, research of the necessary assets provides further requirements belonging to the material domain of DOTMLPF model. This section introduces the most common assets mentioned by different levels of regulations, gives a short explanation of the purpose of those assets, and compares the available Hungarian inventory to the requirements.

Utilizing the highest level regulations for training, the JTAC MOA and STANAG 3797 require having a ground laser target designator and a night target acquisition device as a minimum. All in all, the JTAC training documents do not specify in detail the JTAC inventory related to certification or continuation training. The first specific list describing requirements related to JTAC equipment appears in theater documents. For instance, the CAS standard operating procedure (SOP) of International Security Assistance Force

(ISAF) in Afghanistan provides a list with mandatory and recommended items for JTACs. Furthermore, ISAF makes an effort to implement these rules strictly by checking the equipment JTACs have. The current theater level regulations are the reference to determine the necessary JTAC assets for real operations, and training as well.

JTAC Devices

The following paragraphs describe equipment necessary for a JTAC. Although primarily a ground weapon, the JTAC`s rifle is not just a self-defense asset, but it can be a target designator system, by using tracer ammo, or by providing possibility to mount on it different targeting devices such as 40mm grenade launcher and infrared pointer to make the handling of those devices easier.

The requirement is communication between the air crew and controller. Mainly, radio devices capable of voice and more and more digital communication belong to this group which is essential for terminal attack controlling. The broadband feature is common in every modern radio used for terminal attack controlling.

The third requirement describes targeting assets. A subcategory of these assets facilitates target acquisition in order to identify targets in day and night time. These items are binoculars and night vision assets. The next subcategory provides proper target coordinates for the JTAC. In this case, the items are a compass, maps, and modern devices such as GPS, laser range finder, or special digital maps such as precision strike suite special operation forces (PSS-SOF). Another subcategory consists the target designator assets which are based on laser technology operating on different frequency interval. In addition, a new asset, the remotely operated video enhanced receiver, which

plays an important role in targeting, although it could be mentioned among communication devices as well.

In some special situations, designation of the JTAC`s position is required. Therefore, the last category consists of simple devices such as colorful panels and smoke grenades, or more sophisticated ones like infrared strobes or radar beacons.

After categorizing the main JTAC equipment, the following part of the section highlights specific devices which are deemed mandatory by ISAF. First of all, every JTAC must have one main and one spare broadband radio which are able to operate in encrypted mode. Furthermore, satellite communication capability of the radio can be crucial in case of immediate CAS request from the field. Currently, the most capable and widely spread radios for terminal attack controlling are the backpack type PRC-117 F/G, and handheld type PRC-152 which are the products of the Harris Corporation.

For targeting, mandatory items are the laser range finder and the GPS. The GPS calculates its coordinate and the data (bearing, distance) provided by the laser range finder in order to determine target coordinates. For instance, the Leica Vector 21B or Mark VII laser range finders can create this type of system by connecting the defense advanced GPS receiver (DAGR). Although only an infrared pointer is mandatory for target designation, this device is an essential piece for low level night missions because it reduces the time of voice communication and provides a good visualization of the target position for the air crew while the JTAC aims it at the target directly. The ROVER system works in the opposite way. It facilitate the JTAC`s visualization of the target through full motion video data like the pilot receives in his cockpit. The JTAC is able to check the target visually and prevent a possible fratricide or collateral damage. Therefore,

the ROVER became a mandatory item immediately after it appeared in Afghanistan. Night vision goggles are the last mandatory items. The NVGs are needed to detect the signature of airborne infrared pointers, which help the JTAC to confirm that the air crew identified the correct target.

Finally, two types of devices remain on the list of mandatory items. Both devices provide target marking, and are very simple assets. One is the thermo panel; an orange color panel visible on the ground in day light, or visible on FLIR at night. The other device is the infrared strobe, which identifies the spotter`s position from the target position when the JTAC uses infrared pointer.

There are additional optional items recommended for the JTAC. Most of them are common assets such as a compass or binoculars. However, the ground laser target designators, which were mentioned earlier as the only asset prescribed by JTAC training regulations, are in this group. Ground laser target designators are useful assets against larger number armored targets in conventional warfare, but they are limited in a dynamic environment such as counter-insurgency missions. The ground laser target designator is very heavy, and the installation time prevents the use in a dynamic situation. Therefore, missions using ground laser target designator are conducted from fixed observation points.

There is a wider range of assets necessary for an effective JTAC program than JTAC training regulations describe. Furthermore, the importance, and frequency of using those assets are based on the type of mission as well. Therefore, JTAC must have, and be trained in handling of all types of assets in order to adapt to the current situation, and to support the ground forces in the safest way.

Hungarian JTAC Inventory

The HDF had a significant problem with JTAC equipment at the beginning of the JTAC program in 2006. Indeed, JTACs had only handheld radios, compasses, and binoculars. In 2008, the HDF improved JTAC`s inventory by providing higher performance broadband radios produced by the German Rhode & Schwarz Company, and Leica Vector 21B type laser range finders. The real breakthrough came when the JTAC community received access to the American equipment through the Foreign Military Finance Program. As a result, Hungarian JTACs trained with AN/PVS-14 type night vision goggles, ACR-MS 2000 infrared strobe, and DAGR GPS. In 2011, the HDF received Northrop`s GLTD II type ground laser target designator, Viking 2000 tripod, and SeeSpot III type FLIR. Furthermore, the development of JTAC inventory became a priority of HDF, and other American equipment was ordered through the Foreign Military Sales Program. As a result, the ROVER arrived in 2012, and IZLID 1000 infrared pointers, M4 rifles with M203 grenade launchers are expected in 2013.

According to the plans, Hungary will have all types of JTAC equipment considered necessary for deployment and for conducting JTAC training by the end of 2013. Nevertheless, the total number of each type is still limited, and the maintenance of new equipment expires after the warranty period.

All in all, the HDF has all categories of equipment in small number to conduct an effective JTAC program. The existing JTAC inventory supports continued training, and facilitates effective participation in international exercises. However, HDF has to find a way to create a long term maintenance system for the small amount of JTAC equipment.

Facility Domain

Facilities play a significant role in JTAC training. Effective training requires a JTAC program to have proper training areas such as bombing ranges and simulators.

Proper shooting ranges are essential for live fire exercises in JTAC training. However, the significant constraints such as weather or high costs of realistic training created a demand for a supplementary solution. Simulators provide this solution. What are the requirements for of air-ground bombing ranges and JTAC simulators?

Air to Ground Shooting Ranges

Proper bombing ranges are the foundation of practical JTAC training, and determine the effectiveness of a JTAC program. However, researching the requirements from a JTAC perspective is not sufficient because the JTAC is part of a complex ground fire support system. Furthermore, the sorties supporting the JTAC training are training for the CAS pilots as well. For sufficient training, all elements should be integrated. Therefore, a proper range must meet the requirements of multiple players such as air crews, artillery, ground forces, and JTACs. In arranging the requirements, the following domains are relevant in case of air-to-ground bombing ranges: size of ground and airspace, possibility of integrating all capabilities in one mission, and the possibility of realistic training.

Determining the proper size of a range is impossible, but bigger is the better. Use of longer-range artillery or releasing aerial munitions from medium-altitude requires distances that many ranges cannot provide. Therefore, the size of the range is the main factor limiting the possibility of integration and array of tactics. For instance, smaller ranges provide only a single attack heading or a narrow attack cone which can be

sufficient for basic missions designed for pilots to practice aiming and weapon release. However, CAS is not a basic mission, and requires more attack heading or wider attack cones in order to fulfill the increasing demand of multiple aircraft-type training, which ensures diverse type of experience[9] for air crews and JTACs as well. Beside the size of the ground portion of a range, the dimension of the airspace connected to the range has the same relevance. The ideal place of airspace is definitely larger than the ground place of range to have enough room for deconfliction without the disturbance of missions over the range. Therefore, airspace is a function of the ground place, but the altitude of airspace is not. Doctrine distinguishes CAS tactics by altitude. Missions above 15,000 feet use high-altitude tactics, medium-altitude tactics is between 15,000 and 8,000 feet, and low-altitude tactics is below 8,000 feet.[10] Therefore, the ceiling of the airspace must be at least 20,000 feet above ground level to support high-altitude CAS tactics and provide the safe separation in altitude. In sum, an increasingly robust and flexible range and airspace capability[11] is needed for an effective JTAC program.

Integration of capabilities is the greatest value that a range can have. It is based on the size generally, but a large range without an effective control system for safety is of no use. The integrated elements must be under control, especially for execution of complex tasks. In case of JTAC training, laser operations are a significant source of danger besides using live ammunition. Laser systems used for target designation belong to class 4 safety category, which means they are able to burn skin or to cause permanent eye damage.[12] Moreover, the range of designators is tens of kilometers. Therefore, a range has to have proper regulation, alarm systems, and well-designed target sectors for laser operations.

Probably, the most important factor when determining a firing range is the ability to provide as realistic training as possible.[13] The changing operational environment and increasing amount of lessons learned; the range must satisfy the demands of different type tasks. For instance, providing a wide range of different target sectors including urban environments built from containers, an airfield with mock-ups, or obsolete armored vehicles simulating conventional enemy formations can meet the requirements.

According to the Hungarian range situation, the HDF Bakony Combat Training Center`s bombing range located in north western part of Hungary provides the best possibilities for integrated JTAC training. The size of the range is roughly forty kilometers by fifteen kilometers, but it consists only two sectors where air-to-ground missions are allowed. However, the sizes of those two sectors are similar to the size of the Grayling Air-to-Ground Range in Michigan, where the Hungarian JTAC candidates finished their certification training. The central range was designed for artillery, and supporting air force training was a secondary mission. Consequently, the airspace is limited and is too small for jet aircraft, or in some cases helicopters. Fortunately, there are two temporarily reserved airspace (TRA) around the range. So, the room for deconfliction and holding areas are proper. The real problem with the airspace structure is the 15,000 foot limit except for one small dangerous airspace which was designed for mortars. The range has a published rulebook, which allows and regulates laser operations, and facilitates wide attack cones for CAS missions. Both sectors have their own control tower providing scene for all the target areas. Probably, the greatest shortfall of the range is poor set of targets available. The range does not have any target simulating urban environment or larger manmade facilities, but obsolete armored and soft skin vehicles are

available for targets. Consequently, Hungary has a pretty large size bombing range according to European scale. The range allows laser operations and integrated tasks with air force assets and ground force assets. As a disadvantage, the range is proper for low and medium altitude CAS tactics only. Moreover, the simple set of targets limits realistic training.

JTAC Simulators

Nothing can substitute for integrated CAS control conducted with real aircraft on a proper range. However, live training has many disadvantages such as weather conditions and the lack of realistic mobile targets for troops-in-contact situation.[14] Furthermore, using live ammunition requires stringent and exacting safety measures which degrade the reality of training.[15] Availability of proper assets or sister service units can also be a problem. Further, the costs of real training can be prohibitive. Employment of simulators can mitigate these problems significantly. Therefore, the Air Force Research Laboratory initiated a Joint Terminal Attack Control Training and Rehearsal System research and development project in 2004. The project provided two solutions in 2008.[16]

The first solution was the Part-Task JCAS Training Solutions. This solution has low hardware requirements because only a pilot station integrated with a single screen visualization capability for target viewing is required.[17] Therefore, this system is mobile and easily deployable in theater as well. Although this system, called Indirect Fire-Forward Air Controller Trainer (I-FACT), was not able to support detailed or complex missions, it was extremely useful in basic training of JTACs.[18] The I-FACT focused on the basic controlling procedures such as the 9-line brief to the pilot, because the

simulated environment could not support more difficult tasks like target talk on, which is a method through which the pilot is able to find the target visually.

The second, more sophisticated, solution was the Fully Immersive JTAC Training System. This asset had a robust instructor operation station connected with a 360x180 field of view visual dome.[19] In contrast with the previous solution, this system had a high hardware requirement, and was stationary because of its size. The JTAC situated in the middle of the dome, and could use all of the equipment necessary for realistic control even using the ROVER receiver. The created environment was well-defined and capable of simulating an active enemy, friendly forces, weapon impacts, weather effects, night conditions. Furthermore, the system was able to provide advanced scenarios with the task of coordination with other participants of CAS mission in order to have a fully integrated mission for the JTAC.

The project of Air Force Research Laboratory was relevant because it introduced the two main categories of JTAC simulators. Since 2008, JTAC simulators have been developing. One of the challenges of the progress is how to connect them, and create networks in order to share the available experience in form of scenarios without geographic limitation. This is especially useful when flight simulators designed for pilot training are connected with a JTAC simulator. So, the pilot involved in the mission can fly the mission and not just operate the instructor`s console. The quality of new simulators made these assets an essential instrument of certification training, and changed the focus in continuation training as well, because the two simpler of the six total controls requires maintaining semi-annual currency, which can be conducted in an accredited simulator instead of field conditions.

Probably, the greatest shortfall of the Hungarian JTAC program is the lack of a simulator. Although the PETRA-39C simulator, which was procured for the Gripen pilots` training, and while it can provide a limited capacity for JTACs. It is insufficient for JTAC needs because the instructor screens show the displays of the cockpit but only a poor view of target. Procuring a JTAC simulator is necessary for Hungary in order to improve its JTAC program. Due to the high price of fully immersive type simulators, a simpler part-task type simulator, which is connectable to the PETRA system, would be an initial solution with other simulators following as they become available.

Training Domain

Discussing certification and continuation training of JTACs is a relevant part of this thesis, because Hungarian Defense Force has to develop its own training to have an independent capability. This section introduces the requirements and American experiences in JTAC training to provide a starting point for a Hungarian training.

JTAC Certification Training

The first step to become a JTAC is to complete a course which provides certification of the candidate as a JTAC. The course must be authorized and conducted by an accredited training center. During the course, the candidate receives academic training followed by an exam, and must conduct at least twelve specified controls under the supervision of a JTAC Instructor (JTAC-I) successfully. Finally, the candidate must complete an initial evaluation, which is a control supervised by a JTAC Evaluator (JTAC-E), in order to gain the certified JTAC status. Based on this process, the capability of conducting a JTAC certification training requires an accredited JTAC training facility.

NATO had a JTAC schoolhouse in Fürstenfeldbruck, Germany during The Cold War. However, NATO closed this school and decided to rely on national training institutions when the war ended.[20] Therefore, every nation has to establish a JTAC training facility for a JTAC program. This is not an easy issue because the necessary elements are very expensive, involving material, organization, training, and facilities. Additionally, a JTAC facility must also have access to proper CAS aircraft, an air-to-ground range, and a complete inventory of JTAC equipment. In addition, the costs of material and facility requirements are so high that nations with smaller military budgets cannot afford to establish and sustain an independent JTAC schoolhouse. In this case, cooperation between nations is the only solution. Consequently, the re-establishment of a NATO training center would be useful for smaller NATO nations.

Due to the aforementioned reasons, a complete Hungarian JTAC training center is a long-term goal for HDF. The Hungarian JTAC program was started in 2006 and since then the program has reached the level that the HDF has one JTAC-E and two JTAC-Is. This means that the program has reached the necessary quality, but the number of subject matter experts is still too low for certification training. Another significant issue is the material and facility infrastructure. The lack of JTAC simulators, missing low-level night CAS capability, and video downlink capability preclude effective and full spectrum-training. Therefore, HDF has to maintain and develop relationships with countries that have full CAS capabilities and a complete JTAC training facility in order to provide certification training for candidates until HDF has sufficient sources to procure the missing components. Furthermore, cooperation with countries facing the same resource limitations can improve the current Hungarian JTAC program, and could result a

multinational training center by participating in the JTAC training efforts of other nations. Therefore, the HDF has to make connections with neighboring NATO countries to have a sufficient vision of how effective cooperation can mitigate existing shortfalls or result in a fully-capable JTAC program.

JTAC Continuation Training

When a JTAC is initially qualified by the school and assigned as an accredited JTAC, continuous training is necessary to maintain and improve knowledge and practical skills, as well as retain certification. The process of the continuation training is framed in time intervals and tasks by JTAC/FAC training regulations, JTAC MOA, STANAG 3797 and national JTAC programs. In brief, every JTAC has to receive academic refresher training and pass an exam yearly. The syllabus of academic training, similar to the certification training, must be based on the JTAC/FAC Joint Mission Task List (JMTL). Moreover, the individual conducting the lectures and responsible for the exam must be at least JTAC-I. In addition to the academic part, which is the easier one to manage, a practical exam is mandatory as well. Here there is a difference related to the time intervals between the NATO and US systems. The US regulation requires six controls in the last six months. The control types are specified. For instance, a minimum of three must be fixed wing controls; one must be a night control or involve live or training ordnance release. In contrast, the NATO regulation requires twelve controls in the last twelve months with the caveat that no more than six months can pass between any of the controls. Comparing the two systems, the number of total controls per year is really the same, but the type of the controls is different. Only one ordnance release, but six integrated controls per year are mandatory in NATO, and only four integrated, but two

ordnance release controls per year would be mandatory in the US system. The solution of meeting the requirements of both systems is taking the higher numbers of every specific type of control. Evaluation of practical performance for JTACs happens every eighteen months through an evaluation which is a control supervised by a JTAC-E, in the NATO system. Additionally, there is an additional annual obligation which means that one control per year must be conducted under the supervision of a Supervisory FAC (SUP-FAC). It is important to emphasize that these are minimum requirements, and meeting with these requirements will not contribute to the improvement of JTACs significantly, because they are designed to maintain a basic proficiency level. Therefore, effective JTAC continuation training demands more controls than is the available with current resources. Sophisticated simulators can mitigate resource problems. Furthermore, two of the six controls per half a year can be simulated as long as they were conducted in an accredited simulator.

The demanded material and facility resources of continuation training are the same for certification training except the simulator which is optional. Therefore, the HDF has the basic resources for certified JTAC continuation training, and can conduct their own training. Nevertheless, the previously mentioned shortfalls related to the material domain mean limitations in term of effectiveness.

JTAC Training Experiences

The previous paragraphs discussed the types and demands of JTAC training. It is apparent that the material and facility background of a JTAC program influences the effectiveness of the program. However, even a JTAC program with all needed resources

available cannot be successful without proper training methods which provide practical experience in addition to knowledge.

The entire control process of a CAS mission rests on cooperation between the pilot and JTAC. Therefore, understanding the pilot`s perspective and procedures is essential for a JTAC. The various training centers accomplish this through the combination of instructors and aviators during certification training. However, the certification training is just the beginning for a JTAC, and the real progress in the profession will come through years spent in continuous training. The situation is the same in both training types. JTACs can learn the most from a pilot. Therefore, a continuous link between the professional JTAC and CAS aircrews must be made[21] in order to create and maintain effective training. Furthermore, this relationship works in reverse as well, because an aircrew should understand the JTAC`s perspective too in order to be able to worth more effectively with the JTAC on the ground. Common training could improve not just the knowledge of both sides, but contribute to build trust which is essential for carrying out missions successfully.

Aside from increasing safety in CAS missions, the JTAC`s liaison role is important by translating the ground commander`s intent from army to air force terminology. To do so, the JTAC must understand the ground perspective fully. A typical problem during JTAC training is that the training focuses on the control process only, the scenarios of the missions are neglected; for instance nobody plays the role of the ground commander who limits the JTAC’s options. Furthermore, convenient CAS missions conducted from observation points are still in practice.[22] In fact, the scenarios should be challenging by simulating coordination tasks, implementing commander`s intent, and

making it dynamic, because it is more demanding and stationary CAS controls are not relevant in current fight.[23] All in all, training with the purpose of improving JTACs must focus on the ground scenario, and make the JTAC deal with the challenges of complexity of coordination and demanding tactical situations, because this is the way how the JTAC learns detailed planning and integration required by CAS missions.[24]

Another issue is that many of the fields prescribed by the JTAC JMTL are rarely used. For instance, integration of forward air controller airborne (FAC(A)) is mentioned only in academic training, but there is no effort to implement it in practice. The result is that JTACs do not know or forget the capabilities of a FAC(A), hence they do not consider the FACs role in their missions. The situation is the same for air command and control and air traffic control skills needed for deconfliction. These skills and knowledge are used less in continuation training because of the limited amount of aircraft available. Therefore, continuation training must be thorough and focus on the most relevant fields of JTAC training, while refresher training rarely used scenarios, even if practical execution is not available.

As was mentioned earlier, every JTAC candidate has to take part in preparatory training based on the US JTAC syllabus. However, although the HDF has not been able to conduct certification training on its own, the HDF has the capability to conduct continuation training independently. Therefore, Hungarian JTACs must develop training programs based on experience in order to increase the quality of continuation training. To do so, regular academic refresher training is necessary more often than once a year. Integration of all elements of fires, at least in planning, must be emphasized. The already good level of cooperation between aircrews and JTAC should be emphasized and

improved. Furthermore, HDF has to support participation of JTACs and aircrews in international training and exercises in order to increase the experience gained through cooperation with other nations.

Organization Domain

The purpose of this section is to identify general issues relevant to organizing JTACs into units, and to describe possible structures for tactical air control parties involving JTACs.

General Issues

The current and future fight will be CAS-centric, requiring the most effective use of combined arms.[25] In this case, the role of JTACs and others involved in integration of air-to-ground missions are more relevant. However, the increasing demand for JTACs within NATO has been a problem since approximately 1995.[26] Although JTACs work with ground forces directly, they are members of air forces. So, the number of JTACs depends on air force training capacity instead of the demand of the ground forces. Therefore, the lack of JTACs causes tensions between ground forces and air forces. As a result, ground forces want to develop own training in order to maximize the number of controllers and mitigate shortfalls. The problem is that the ground forces do not have proper assets and experience to conduct effective training independently. Moreover, the JTAC is the part of a liaison system belonging to the air force. Overall, the best solution is when the JTACs come from the air force, because they can receive the most effective training and are familiar with the culture of air force which is essential in case of

cooperation and liaising. Nevertheless, there are possibilities and situations that differ from this solution.

Due to the problem of insufficient numbers of JTACs, the US Army initiated the Joint Fires Observer (JFO) program to mitigate the shortages of JTACs. JFOs receive shorter and less effective training from ground forces. Therefore, JFOs are not authorized to conduct terminal attack control, and give clearance for weapon release. However, they function as a force multiplier when working with a JTAC by providing target information so the JTAC located far from the target area can provide clearance to the aircraft against multiple targets in the area of operation.

Besides the ground forces` unsatisfied demand towards JTACs, another difficult situation arises when the air force is not able to provide JTACs trained properly to support a ground unit, where a demanding and long basic training is required for successful operations. Therefore, special force units typically have their own JTACs, because the air force could not provide the needed ground training for JTACs assigned to special force units.

The next significant point is what is the best background for being a JTAC/FAC or air liaison officer (ALO)? The answer is evident. A trained CAS pilot is the most competent person to understand the perspective of another CAS pilot, and to provide terminal attack control. On the other hand, JTACs and ALOs have to understand and know the procedures of ground forces as well. In this case, CAS pilots do not have the same advantage. Furthermore, the expense of pilot training makes it economically inefficient to employ a pilot as a JTAC, especially when experienced airmen with different backgrounds can receive proper training, and act as JTACs effectively.

However, the training of an airman with ground experience is lengthy[27] and expensive because of the involvement of aircraft. Therefore, The JTAC military occupational specialty (MOS) became a primary MOS, in order to keep the person with the knowledge and experience gained in a lengthy and expensive way in the same career field. As a result, highly experienced JTACs can reach the proficiency level needed for air liaison officer position, hence they can replace pilots at the battalion level.[28]

According to the HDF, the same issues exist in the HDF JTAC program. Originally, pilots were responsible for forward air controlling, but this mission was only secondary for them. When the Hungarian Air Force established a permanent unit, the positions were filled with infantry officers who had sufficient English language skills. They had the proper knowledge related to army procedures as well. So, their training focused more on the air force knowledge and procedures. As a result, they could gain enough experience and cultural awareness of both services that would make it possible to extend the career field of JTACs to serve as a battalion level ALO. Therefore, HDF should employ its current air force JTACs as ALOs instead of employing pilots in this position.

Another issue for HDF, and probably for all of the non-native English speaking countries as well, is that a high level English knowledge is expected from officers. However, this means that selecting officers to be a JTAC based on English language skills only is the easier way but it must not be the only way. Nowadays, many senior and a few junior non-commissioned officers (NCO) in HDF have high English proficiency level and are able to work as a JTAC effectively. The precedent is the Hungarian Special Forces where JTACs are NCOs. Therefore, Hungarian Air Force should investigate the

possibility of opening JTAC positions for NCOs, and should assign the JTAC qualified officers as ALOs.

A further improvement related to organizational issues should be to establish a permanent JTAC unit in the Special Forces battalion of the HDF. Currently, Hungarian Special Forces has four qualified JTACs and more would be necessary in order to support their operations. The problem is that the JTAC is a secondary MOS in the battalion. Thus, the focus to maintain currency and continuation training are secondary as well. Therefore, the HDF should create a career field for JTACs serving in Special Forces by establishing a permanent JTAC team able to fulfill the demands of Special Forces battalion.

TACP Structures

The main factors in the structure of an organization are the role, the command echelon, and operating circumstancies. The tactical air control parties (TACP) are part of the air command and control system, and function as liaison elements delegated from the air force to the ground forces. Their general roles are advising and assisting the ground commander, taking part in the planning process of the operations, requesting and coordinating preplanned and immediate air support by operating and monitoring air request nets, dealing with the airspace management activities in the assigned area of operation, coordinating with local air defense and other airspace users in order to deconflict air traffic, and providing terminal attack control for air strikes.[29] Overall, TACP is responsible for contributing to the operations continuously by providing the knowledge related to the capabilities and limitations of air assets by working with ground fire cells very closely.

TACPs are located generally at each command echelon from battalion through corps. The general tasks are the same, although the ratio between those tasks can differ. For instance, execution of terminal attack controls is in focus beside the advising and planning on battalion level. In contrast, managing the air support requests, distributing and deconflicting available air assets are the priority at higher echelon level. Therefore, different level TACPs require different structures depending on number, skill sets, and experience of TACP members.

To define the structure of TACPs, an explanation of key positions is needed. Starting from the top, the ALO is the leader of the TACP. The ALO is JTAC qualified, hence he or she can perform all of the roles required by a TACP. Nevertheless, the main responsibilities of an ALO are advising the ground commander in order to integrate all aviation assets in support of maneuver elements, and liaising between aviation and air units.[30] Additionally, the ALO is responsible for the management of training, the employment, and the standardization of the TACP members.[31] There are JTACs under the supervision of ALO. The main responsibilities of them are coordinating, integrating, and directing the actions of combat aircraft engaged in close air support and other offensive air operations.[32] Also, JTAC`s role is to take part in preparation and conduct the execution of close air support missions.

For the coordinating and liaising tasks, ALOs have to use significant amount of radio assets, and monitor multiple frequencies. Furthermore, these radios are built in a mobile workstation that requires a driver as well. A single person could not manage all of the tasks alone. Therefore, TACPs consist of other individuals with the role of assistance beside the two key positions, ALO and JTAC. US Air Force calls them radio operator

maintainer and driver (ROMAD), and being in this position is one of the requirements for a junior NCO to apply for a JTAC position. In the United States Marine Corps, the term of radio operator (RO) is used. Regardless of the exact term, ROMADs have a wide array of responsibilities. They must be trained to use all communications gear and ensure the other members are able to do so also. Additionally, ROMADs must be familiar with the use of and maintenance of TACP vehicles and all assigned target acquisition equipment used during JTAC mission.[33] Although NATO publications do not mention radio operators, they describe the responsibilities and duties of ROMADs as well as training requirements of laser operators (LO) who work assisting FACs.

An additional category of assistants is the joint fires observer. Although JFOs are not members of the TACP, but they work in close connection with JTACs and ALOs, and are considered as a force multiplier of a TACP. JFOs are highly trained in spotting targets for artillery assets, and are aware of JTAC procedures. Therefore, they can provide information such as accurate target descriptions, target coordinates, and battle damage assessment to the JTAC located far from the target area. Furthermore, JFOs can take part in target designation when they are equipped with proper assets.

After determination of positions, defining of the structure of TACPs is possible through assigning numbers to the positions. In theory, an experienced JTAC can fulfill all of the missions by training, but not at the same time. Furthermore, a single JTAC can not deal with unlimited aircraft overhead without loosing effectiveness and waisting resources. Therefore, the exact structure will define the capacity of the TACP. For instance, the US Air Force provides TACPs to the US Army for every command echelon from battalion level. Ussually, an aviator or a senior JTAC helped by a couple of

ROMADs form the battalion level TACP, because of the low number of available qualified JTACs. The single JTAC, who is the ALO as well, is supported by the companies` JFOs. This structure ensures that all of the companies have access to close air support, and the battalion staff is able to implement joint capabilities in the operations. However, the small number of participants limits effectiveness especially in continuous operations because the single JTAC is not able to take part in the planning process conducted by the battalion staff, coordinate, and control multiple engaging aircraft in the same time or for a long term. Therefore, this structure requires reinforcement when the supported battalion has access to large amount CAS sorties or conduct continuous operations. In contrast, the USMC created a robust TACP structure can support the battalion in any circumstances. A battalion level TACP consists three FACs, who are aviators and serve as ALOs, and twelve radio operators. In addition, every company has an organic JTAC, and every platoon has a JFO. Consequently, the company JTACs and JFOs can cope with dense CAS sorties, and the FAC parties formed from the ALOs and radio operaters are able to advise, plan, and coordinate continuously.

Based on the elements described above, the HDF should consider changing the TACP structure in the following way. On the battalion level, where the focus is on the execution of CAS, a single officer rank JTAC with ground forces background could be the ALO, who is responsible for advising and coordinating, and works in the tactical operation center. A ROMAD is necessary to help the ALO`s job with managing the communication networks. Because the ALO is involved in the staff work and tied to the operation center, a JTAC is needed in order to provide presence in forward positions on the battlefield, and to support the companies directly if necessary. A single JTAC is not

able to fulfill every type of mission alone. Typically, operations involving ground laser target designators and indirect fire demand a single JTAC, because handling and aiming the designator, or coordinating with the artillery unit in the same time when JTAC must focus on controlling and clearing the engaging aircraft is a source of mistakes. Therefore, a JTAC on the field needs proper assistant who can assist in target acquisition, target designation, and in coordination with artillery when indirect fire is involved in the mission. To help the JTAC effectively, the assistant has to be familiar with the basic procedures as well. Therefore, the best person can help a JTAC in every condition is a JFO.

Consequently a basic building element or team of a TACP must consist of an ALO, a JTAC, a JFO, and a ROMAD as a minimum. Battalion level TACPs could be task organized based on the requirements and tasks of the supported unit by being built from these teams. For instance, a battalion functioning as a main effort and requesting large amount of CAS sorties could have a TACP built from three teams. This means that three ALOs and ROMADs could provide continuous service in the staff, and every company could have a JTAC and a JFO. On the other hand, a battalion with supporting tasks could have only one team as a TACP which could provide access to CAS missions.

In case of brigade level TACPs, HDF can continue the current practice and assign aviators in temporary ALO roles. However, investigating the possibility of improving and promoting the experienced battalion ALOs to be a brigade level ALO would be useful in order to create a full career field for JTACs.

Conclusion

The purpose of this chapter was to answer the research questions in order to identify requirements for a sustainable and improved Hungarian Defense Force JTAC Program. Using the DOTMLPF model, which is designed to identify capability gaps and solutions, facilitates logical organization of chapter 4, and enables to gain a full spectrum overview of the problem. First, the requirements of CAS aircraft and JTAC equipment were investigated what revealed the shortfalls of HDF in material domains. In the further sections, air to ground shooting ranges and JTAC simulators as part of the facility domain, training requirements, and organizational issues were discussed in order to highlight the capability gaps and find possible solutions and recommendations, which will be summarized in chapter 5.

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CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

This chapter provides the conclusions and associated recommendations based on research and analysis in chapters 3 and 4 to determine how the Hungarian Defense Force can create an independent and more effective JTAC program. The organization of this chapter follows the order of chapter 4, and discusses the results and recommendations based on the four DOTMLPF domains of material, facilities, training, and organization. Finally, chapter 5 recommends short and a long term recommendations to establish an independent and effective JTAC program.

The research started with investigation of the material domain, focusing on aircraft and the JTAC equipment inventory, because this field presents the backbone of a JTAC program by determining requirements and capabilities. The research identified the fixed wing JAS-39 Gripen as meeting all of the requirements dictated by US and NATO regulations, although there are shortfalls affecting ordnance effectiveness and precluding full spectrum training. To mitigate these shortfalls, the HDF has to concentrate on materials. First of all, procuring training ordnance such as BDU-33 is essential for the JTAC program, and this inexpensive asset is more cost effective. Therefore, HDF has to consider the procurement of practice ordnance as a primary short term material solution. Another issue is improving the Gripen`s digital communication capability by upgrading the Litening III pod. As a solution, procuring the ROVER emitter for Litening III pod must have high priority to mitigate relevant shortfalls. Additionally, the HDF should procure NVG devices for the air crews` night qualification to improve the Gripen`s CAS capability needed for full spectrum training.

The HDF possesses a small amount of the required equipment acquired through FMF and FMS programs, and is able to facilitate every type of training. However, these assets are new, and not fully integrated yet. Therefore, HDF has to make efforts to create a long term maintenance and replacement solution for these assets.

Continuing with the facility domain, air-to-ground shooting ranges and JTAC training simulators were studied. As a conclusion, the strongest point of the Hungarian JTAC program is the central shooting range located in the north western part of Hungary. The size and current regulations of the range facilitates a wide range of live missions such as integrated and laser missions, although there are necessary improvements such as the increase of the current 15,000 foot altitude limit of the airspace attached to the range, and the improvement of simple target sets.

In contrast, the facility domain is the weakest point of the program as well. The HDF does not have any sufficient simulation ability to support the training of JTACs. Therefore, the priority for the HDF should be the facility domain which requires the most improvement. The short term solution is the procurement of a part-task type simulator that means lower cost. However, the best solution is to purchase an immersive type simulator that is optimally able to support complex scenarios and connect to the existing HDF flight simulator.

The research concluded that HDF has the sufficient background, proper aircraft, training facility, qualified JTAC-Is and JTAC-E, to conduct proper continuation training in order to keep JTACs qualified. However, conducting JTAC certification training is not possible because of the shortfalls in resources, especially the lack of simulators. Therefore, the HDF must focus on the relationship with other countries to eliminate the

problem of certification training while the simulator issue is resolved. The solution can be as simple as access to a foreign accredited JTAC schoolhouse. Additionally, the increasing quality of continuation training must be the goal in the short term by providing the resources, implementing the experiences gained in Afghanistan, and conducting integrated training. In the long term, setting the conditions for certification training must be the focus.

Finally, reconsideration of the current organization of TACPs is beneficial for the HDF. Establishing a unit involving full-time JTACs supporting Hungarian Special Operation Forces is necessary in order to keep already qualified individuals in a JTAC position for a longer time. Additionally, the Hungarian Air Force should investigate the possibility of an ALO career field for JTAC qualified officers and opening JTAC positions for NCOs. Furthermore, the organization of TACPs should be built from smaller elements from every profession such as ALO, JTAC, JFO, and ROMAD to facilitate task organization.

A fully independent JTAC program is not a realistic goal for the HDF in the short term. The main reason is that the HDF is not able to conduct proper JTAC certification training because of the shortfalls in resources such as training ordnance, and simulators. On the other hand, HDF has the majority of necessary resources, hence building a full JTAC capability is not impossible at all in long term. Therefore, the HDF must also investigate solutions for resource shortfalls. The HDF should implement the recommendations from this thesis in order to establish a program capable of certifying JTACs for a wide-range of missions and maintaining the currency of JTAC personnel.

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